

MF SERIES/MF-U SERIES

Catalog No. E4153-176



Higher performance measuring microscopes stretch the boundaries

Mitutoyo



Expectations of Measuring Microscope Performance

A measuring microscope is a versatile instrument featuring highly accurate linear measurement as well as observation functions. This combination enables detailed inspection of products such as semiconductors, electrical and electronic parts, precision automobile components, plastic moldings, tools, and medical goods. Delicate workpieces that would be deformed by contact measurement and workpieces with details too small to be traced by a contact probe can be easily measured.

The essential element of a measuring microscope is an optimum balance of optical performance, accuracy and ease of operation. Objects that were previously invisible, or only barely visible, can now not only be observed but also measured. We believe that customer expectations of measuring microscope performance will keep on growing, and this must be matched by ease of use, high measurement throughput and environmental friendliness. Mitutoyo will continue to deliver high-quality and high-definition measuring microscopes while maintaining our commitments and beliefs in order to fulfill our responsibility to support fundamental industrial technologies.



In-House Design

Mitutoyo designs all measuring microscope main units, optical systems (including lenses), and the digital scales that are essential for accuracy.

This approach enables a level of support that otherwise would be impossible, and puts us in a position to speedily comply with our customers' specific requests as far as practicable.



Concept Design, Manufacturing, and Evaluation of Microscope Main Units and Components



Development Design, Manufacturing, and Evaluation of Optical Systems and Lenses



Development, Manufacturing, and Evaluation of High Accuracy Digital Scales





Superlative Optical Performance

Thanks to a new design of optical tube and modification of the objective lens specifications, flare that occurs within the optical system is suppressed as much as possible so that minute details on the workpiece are clearly shown. In addition, the internal black finish achieves a high image contrast and clear observation. The MF-U Series is equipped with the established FS system metallographic microscope head which provides vivid images of high color reproducibility and features primary-color correction. (The objective lenses are plan apochromat*.)

With much higher lighting efficiency in the optical system, which ensures sufficient illumination intensity, this series attains high-magnification measurements and a dark-field observation environment that is efficient and less tiring.

*Primary color and chromatic aberration in the wavelength range of the three primary colors (blue, yellow and red) are corrected.



Image brightness is about double compared with conventional microscopes.

Conventional microscope



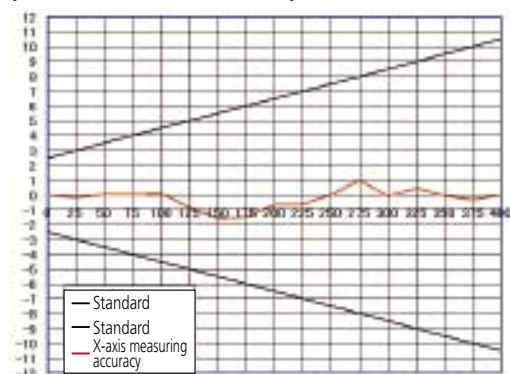
MF/MF-U Series microscopes



Image of outer cover of floppy disk

Measuring Accuracy Approaching JIS Level 0

(Common to MF and MF-U)



Uncertainty (X, Y) = $(0.25 + 0.02L)\mu\text{m}$

Reference : JIS B 7153 measuring microscope measuring accuracy at each axis (20°C)
 Level 0 ($2 + 0.01L\mu\text{m}$ or less) Level 1 ($4 + 0.02L\mu\text{m}$ or less)
 L = measurement length (mm)

Measuring microscopes must operate at a high level in terms of measuring accuracy and optical performance.

This series achieves the quoted measuring uncertainty for all stage sizes**.

We believe that this series, which achieves a large measurement range and high accuracy at the same time, will help you in every measurement situation.

**Measured conforming to the measurement method at each of the X and Y axes stipulated by JISB7153.

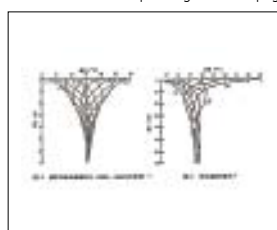
The digital scale built into the microscope body is a photoelectric type transmission linear encoder, with a maximum response speed of 50 m/min. This scale features high accuracy specifications developed in our underground research facility which is equipped with the world's highest scale accuracy evaluation technology.

Mitutoyo acquired the first certification for calibration of line standards (standard scale of 500mm or less) in Japan.

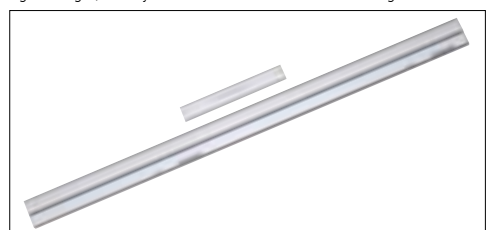
Microscope images on this page are digital images, so they differ somewhat from the actual images.



Line standard calibrator



Underground facility temperature fluctuation graph



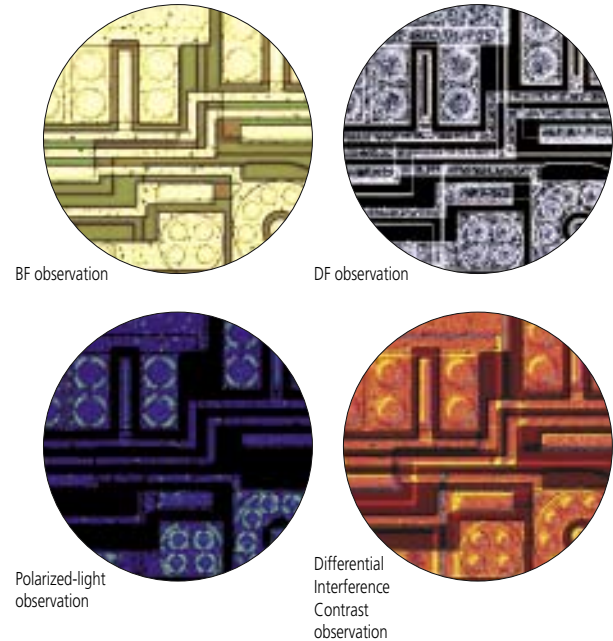
Glass scales



Applications of the Measuring Microscope

Multimode Observation

These microscopes combine metallographic observation functions such as DF mode (to observe surface scratches and minute steps which are difficult to see in BF mode), Polarized Light mode (to observe the hue and image contrast to suit the polarization characteristics using the polarizer and analyzer) and Differential Interference Contrast (to observe minute surface steps, or similar features, as color image contrasts while using the polarization filter and differential interference prism at the same time) with measurement functions.

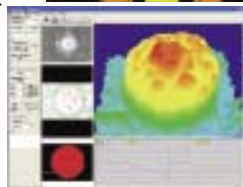


Saving High-Resolution Images

Anyone can easily take high-resolution microscope images mounting a high-pixel digital camera onto the main unit. It is also possible for many users to observe and analyze the image displayed on a monitor at the same time. You can also generate inspection tables with images attached.

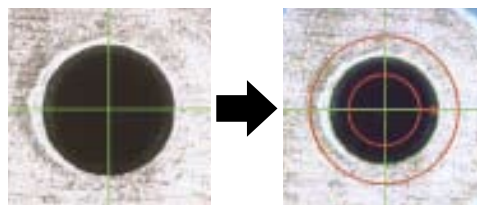
3D Image Analysis

Even if the microscope image has shallow depth of focus, you can easily acquire an omnifocal image using a special program. Furthermore, these microscopes can also achieve a 3D display at low cost and in a short space of time.



High Accuracy Measurement

This is a high-value-added system based on a microscope that can not only measure length (and height, optionally) but also check the processed state of a surface and other elements while peering through the eyepiece. The automatic edge input function for image measurement enables edges to be input without moving the stage if the target falls in a single screen image, improving the measurement efficiency.



Microscope images on this page are digital images, so they differ somewhat from the actual images.

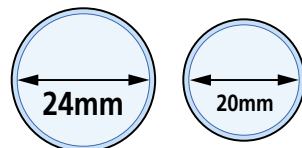


Ergonomic and High Performance Design Features

Widefield Eyepiece

(common to MF and MF-U)

This eyepiece has the best-in-class field number* of 24mm (10X). Because the visual field through the eyepiece is so wide, strain on the eyes is small, reducing fatigue during extended periods of observation or measurement. In addition, each eyepiece has independent diopter adjustment.



*Target range within the whole field of view using the 1X objective lens.

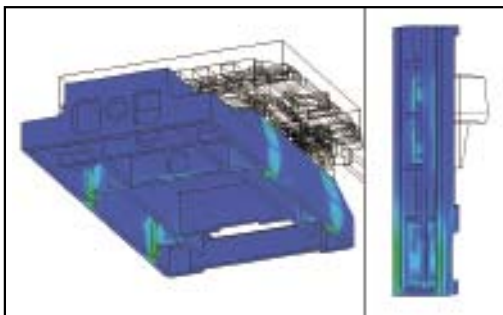
Highly Rigid Structure

(common to MF and MF-U)

The microscope column supporting the optical tube, and the base supporting the whole body, have been optimized for high rigidity using FEA analysis techniques to guarantee high accuracy measurement and blur-free observation throughout the entire stroke at any magnification. The column is stiffened by an internal transverse rib and the power supply is external to reduce heat effects. Also, during development, these microscopes were repeatedly subjected to drop tests*, transportation tests* and wear tests* to prove their durability in maintaining a sharp, clear field of view with the specified accuracy under normal conditions of transport and use.



Column



*Mitutoyo's original tests using specially packaged products.

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Digital Display with High Visibility Display

(common to MF and MF-U)

Because the minimum reading of the digital counter (with two or three axes), which is equipped with all the models as standard, can be switched between $1\mu\text{m}$, $0.5\mu\text{m}$ and $0.1\mu\text{m}$, high resolution measurement is possible. The zeroset, direction changeover, and smoothing functions are also featured as standard. Since the highly versatile RS-232C interface is adopted, data can be output to a general-purpose printer or personal computer. The counter display alone can be output to spreadsheet software. The digital counter can be installed onto the left or right side of the column.



Front of counter



Rear of counter

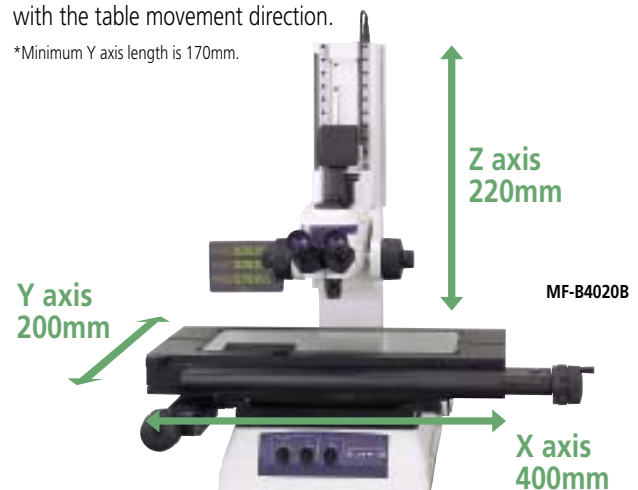
A Wide Measuring Range

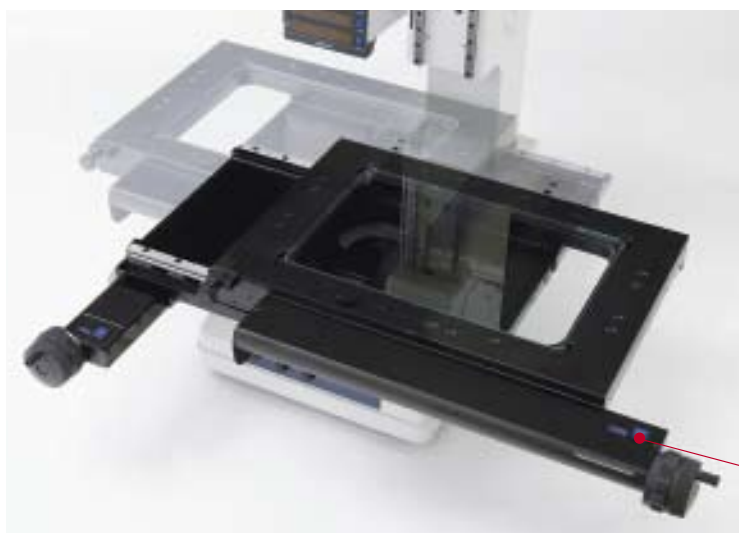
(common to MF and MF-U)

Workpiece sizes differ from minute to large. Because measuring microscopes are widely used various industries, they many variations of measurement range.

This series has a wide measurement range of 400mm (X axis) $\times$ 200mm (Y axis) $\times$ 220mm (Z axis), useful for measuring of boards, shafts, and other workpieces. This series also incorporates a swivel rotation mechanism* which is helpful for aligning the workpiece with the table movement direction.

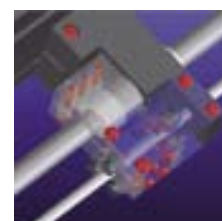
*Minimum Y axis length is 170mm.





Zeroset switch

Quick release handle



Twist roller method

Built-in Quick Release Mechanism and Zeroset Switch (common to MF and MF-U)

The stage feed can be switched between coarse and fine feed (FREE/LOCK) by using the quick release handles. These are very useful when measurement distance is long by allowing a quick return to the datum point, since the stage becomes completely free. Because this mechanism adopts the twist roller method, you can experience smooth feeding with little impact when switching it. In addition, you can keep your grasp on the handles during measurement, except when focusing the microscope, because the counter's zeroset switch is built in near the handle*.

When the zeroset switch is pressed, an operation alarm sounds.

*The zeroset switch is built into the X and Y axes, not in the Z axis.



Standard Handles Fixed to Both Sides of the Z Axis (MF and MF-U)

The Z-axis handles provided on both ends of the column as standard allow right-handed and left-handed users to easily operate this microscope. The digital counter can be mounted onto either end of the column, so enabling an operating environment suited to the user's dominant hand. The handles are ergonomically positioned so that anyone can comfortably operate them.

Standard Tilting Optical Tube (MF-U only)

Comfortable observation is achieved through eye point adjustment to meet the varying physical sizes of operators. The angle of the column can be fixed anywhere from 0 to 30 degrees. The reticle inside the optical tube is replaceable.

Slide Type Nosepiece (factory-set option for MF)

Generally, only one objective lens can be mounted onto the MF (limited calibration optical system), so it must be removed and replaced with another to change magnification. The slide type nosepiece, which can hold up to two objective lens, allows quick change of magnification.

Note: External lighting cannot be used at the same time.

Measuring Microscope

MF Series

MF-B505B

*The binocular tubes (eyepieces) are optional.



MF-B1010B

*The binocular tubes (eyepieces) are optional.



MF-B2010B

*The binocular tubes (eyepieces) are optional.



MF-B2017B

*The binocular tubes (eyepieces) are optional.



MF-B3017B

*The binocular tubes (eyepieces) are optional.



MF-B4020B

*The binocular tubes (eyepieces) are optional.



Features

- › Clear erect image in widefield view, with flare suppressed by the new optical system (3X: 80% reduction in flare compared with conventional products*)
- › Employs the high NA objective lens, ML Series, just for the MF (long working distance specifications).
- › Supports high-magnification eyepiece observation of up to 2000X.
- › The adjustable aperture diaphragm (reflection/transmission) allows measurements with suppressed light diffraction.
- › Quick release mechanism useful for making rapid long range measurements
- › Precise focus and observation/measurement using the coarse/fine feed Z handles incorporated onto both sides as standard.
- › Standard measuring microscope with a wide variety of attractive options such as an Vision Unit

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* Mitutoyo survey

Specifications

Without Z axis length measurement	Model No.	MF-A505B	MF-A1010B	MF-A2010B	MF-A2017B	MF-A3017B	MF-A4020B
	Order No.	176-561	176-562	176-563	176-564	176-565	176-566
With Z axis length measurement	Model No.	MF-B505B	MF-B1010B	MF-B2010B	MF-B2017B	MF-B3017B	MF-B4020B
	Order No.	176-581	176-582	176-583	176-584	176-585	176-586
Optical tube	Monocular or binocular tube option (angle of column: 25); standard TV camera port in all models; reticle (cross hairs of broken line, line width: 5µm); optical path switching (observation / TV camera = 50 / 50)						
Image	Erect image						
Observation method	BF observation						
Eyepiece (option) adjustable diopter	10X (field number: 24), 15X, 20X Note: Monocular tube: one 10X lens, binocular tube: two 10X lenses						
Objective lens	ML objective lens 3X (standard), 1X, 5X, 10X, 20X, 50X, 100X						
Focusing system	Maximum target height	150mm			220mm		
	Focusing method	1-axis coarse / fine feed, left and right handles (coarse feed: 30mm / revolution, fine feed: 0.2mm / revolution)					
Illumination unit	Transmitted light	Telecentric system, adjustable aperture diaphragm, non-stepped brightness control, 12 V 50 W tungsten-halogen lamp, built-in cooling fan					
	Reflected light	Koehler illumination, adjustable aperture diaphragm, non-stepped brightness control, 12 V 50 W tungsten-halogen lamp, built-in cooling fan					
	Filter for illumination	One GIF filter and one LB80 filter attached (can be set to either of the transmitted or reflected illuminator)					
Stage	Measuring range	50 x 50mm	100 x 100mm	200 x 100mm	200 x 170mm	300 x 170mm	400 x 200mm
	Top size	280 x 280mm	280 x 280mm	350 x 280mm	410 x 342mm	510 x 342mm	610 x 342mm
	Effective stage glass size	180 x 180mm	180 x 180mm	250 x 150mm	270 x 240mm	370 x 240mm	440 x 240mm
	Swiveling angle	—			±5°(left)		±3°(left)
	Maximum loading (on top of the glass)	10kg			20kg		15kg
	Quick release mechanism	X and Y axes (standard)					
	Zeraset switch	X and Y axes (standard), (MF-B type also features for Z axis as standard)					
Length measuring system	High accuracy digital scale*1						
Digital counter	Minimum reading	Switchable between 1/0.5/0.1µm					
	Display axis	X and Y axes (X, Y, and Z axes in MF-B type)					
	Functions	Zeraset, direction changeover, and RS-232C output					
Measuring accuracy*2 (X and Y axes: no load)		(2.5 + 0.02L)µm L: measuring length (mm)					
Maximum power consumption		250 W					
Main unit	External dimensions (W x D x H)mm	562 x 730 x 667	562 x 730 x 667	624 x 745 x 667	632 x 892 x 782	682 x 892 x 782	757 x 907 x 782
	Weight	65.5kg		69.5kg	130kg	138kg	144kg
Control box	Specifications	Power ON / OFF switch, 100 to 120 VAC (5A fuse) / 220 to 240 VAC (2.5A fuse), GND terminal					
	Weight	2.2kg					

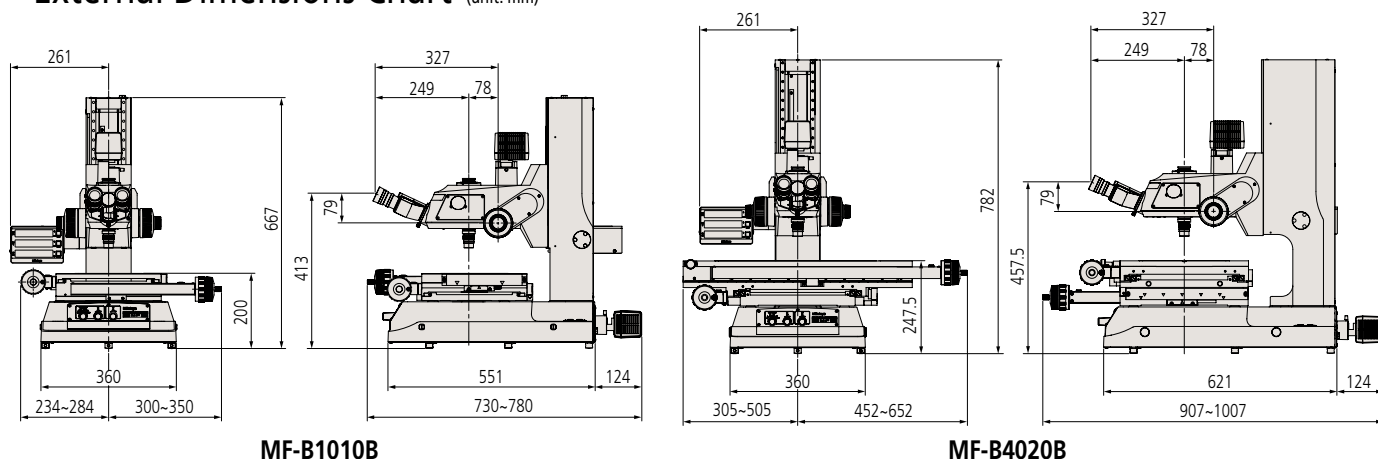
*1: Patented in Japan

*2: The measurement method conforms to JISB7153.

Spare lamp (common to transmitted and reflected illuminators): 12 V 50 W tungsten-halogen lamp No. **513667**

A long-life lamp (No. **12BAB345**) is also available, though the illumination intensity is slightly low.

External Dimensions Chart (unit: mm)



Universal Measuring Microscope

MF-U Series

MF-UB505B

*The revolving nosepiece, objective lenses, and fiber-optic illumination are optional.



MF-UB1010B

*The revolving nosepiece, objective lenses, and fiber-optic illumination are optional.



MF-UB2010B

*The revolving nosepiece, objective lenses, and fiber-optic illumination are optional.



MF-UB2017B

*The revolving nosepiece, objective lenses, and fiber-optic illumination are optional.



MF-UB3017B

*The revolving nosepiece, objective lenses, and fiber-optic illumination are optional.



MF-UB4020B

*The revolving nosepiece, objective lenses, and fiber-optic illumination are optional.



Features

- › Clear erect image in widefield view, with flare suppressed by the new optical system (2X: 80% reduction in flare compared with conventional products*)
- › Employs the established FS optical system high NA objective lens MPlanApo/BDPlanApo/GplanApo Series (long working distance specifications)
- › Offers high-resolution observation and high accuracy measurement solutions by combining the metallographic microscope and measuring microscope functions into a single microscope.
- › Supports high-magnification eyepiece observation of up to 4000X.
- › The adjustable aperture diaphragm (reflection/transmission) mechanism allows observation measurements with suppressed light diffraction.
- › Quick release mechanism useful for making rapid long range measurements
- › Precise focus and observation/measurement using the coarse/fine feed Z handles incorporated onto both sides as standard.
- › Standard measuring microscope with a wide variety of attractive options such as an Vision Unit

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* Mitutoyo survey

Specifications

Without Z axis length measurement	BF (Bright-Field)	Model No.	MF-UA505B	MF-UA1010B	MF-UA2010B	MF-UA2017B	MF-UA3017B	MF-UA4020B
		Order No.	176-567	176-568	176-569	176-570	176-571	176-572
	BD (BF/DF)	Model No.	MF-UC505B	MF-UC1010B	MF-UC2010B	MF-UC2017B	MF-UC3017B	MF-UC4020B
		Order No.	176-573	176-574	176-575	176-576	176-577	176-578
With Z axis length measurement	BF (Bright-Field)	Model No.	MF-UB505B	MF-UB1010B	MF-UB2010B	MF-UB2017B	MF-UB3017B	MF-UB4020B
		Order No.	176-587	176-588	176-589	176-590	176-591	176-592
	BD (BF/DF)	Model No.	MF-UD505B	MF-UD1010B	MF-UD2010B	MF-UD2017B	MF-UD3017B	MF-UD4020B
		Order No.	176-593	176-594	176-595	176-596	176-597	176-598
Optical tube			Trinocular tilting optical tube (angle of column: 0 to 30); siedentopf type pupil distance adjustment: 51 to 76mm; 1X built-in tube lens; reticle (broken-line crosshairs, line width: 5μm); optical path switching (observation/TV camera = 50/50)					
Image			Erect image					
Observation method			BF/DF (MF-UC, UD type only), polarization, and differential interference					
Eyepiece (option) adjustable diopter			10X (field number: 24, two eyepieces are supplied as standard), 15X, 20X					
Objective lens (option)	Bright-Field (BF)		All of M Plan Apo, M Plan Apo SL, G Plan Apo lenses					
	BF/DF (BD)		All of BD Plan Apo and BD plan Apo SL lenses					
Revolving nosepiece (option)	Bright-Field (BF)		Aligning parfocal manual revolving nosepiece / aligning power revolving nosepiece (either one selectable)					
	BF/DF (BD)		Manual revolving nosepiece / power revolving nosepiece (either one selectable)					
Focusing system	Maximum target height		150mm			220mm		
	Focusing method		1-axis coarse / fine feed, left and right handles (coarse feed: 10mm / revolution, fine feed: 0.1mm / revolution)					
Illumination unit	Transmitted light		Telecentric system, adjustable aperture diaphragm, non-stepped brightness control, 12 V 50 W tungsten-halogen lamp, built-in cooling fan					
	Reflected light		Koehler illumination (BF / BD), adjustable aperture diaphragm, non-stepped brightness control, fiber optic cable cold light illumination 12 V 100 W halogen / 12 V 150 W halogen (either one selectable)					
	Filter for illumination		One GIF filter (for transmitted illuminator)					
Stage	Measuring range		50 x 50mm	100 x 100mm	200 x 100mm	200 x 170mm	300 x 170mm	400 x 200mm
	Top size		280 x 280mm	280 x 280mm	350 x 280mm	410 x 342mm	510 x 342mm	610 x 342mm
	Effective stage glass size		180 x 180mm	180 x 180mm	250 x 150mm	270 x 240mm	370 x 240mm	440 x 240mm
	Swiveling angle		—			±5°(left)		±3°(left)
	Maximum loading (on top of the glass)		10kg			20kg		15kg
	Quick release mechanism		X and Y axes (standard)					
	Zeroreset switch		For X and Y axes (standard), (MF-UB and UD types features also for the Z axis)					
Length measuring system			High accuracy digital scale*1					
Digital counter	Minimum reading		Switchable between 1/0.5/0.1μm					
	Display axis		X and Y axes (X, Y, and Z axes in MF-UB and UD types)					
	Functions		Zeroreset, direction changeover, and RS-232C output					
Measuring accuracy*2 (X and Y axes: no load)			(2.5 + 0.02L) μm L: measuring length (mm)					
Maximum power consumption			150 W					
Main unit	External dimensions (W x D x H)mm		562 × 730 × 667	562 × 730 × 667	624 × 745 × 667	632 × 892 × 782	682 × 892 × 782	757 × 907 × 782
	Weight		65.5kg		69.5kg	130kg	138kg	144kg
Control box	Specifications		Power ON / OFF switch, 100 to 120 VAC (5A fuse) / 220 to 240 VAC (2.5A fuse), GND terminal					
	Weight		2.0kg					

*1: Patented in Japan

*2: The measurement method conforms to JISB7153.

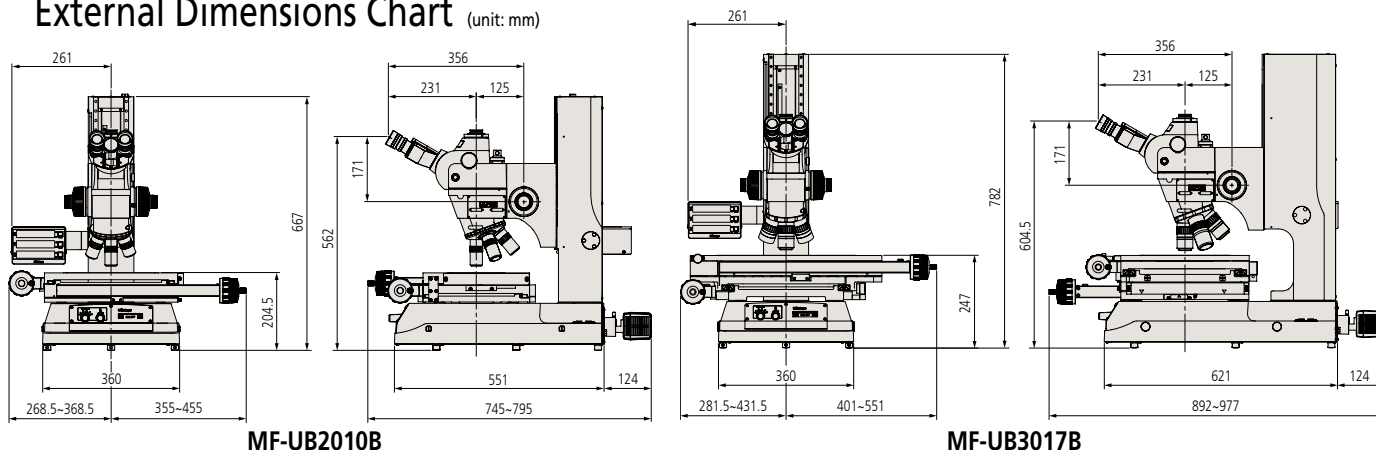
Spare lamp (For transmitted illuminator): 12 V 50 W tungsten-halogen lamp No. **513667**

A long-life lamp (No. **12BAB345**) is also available, though the illumination intensity is slightly low.

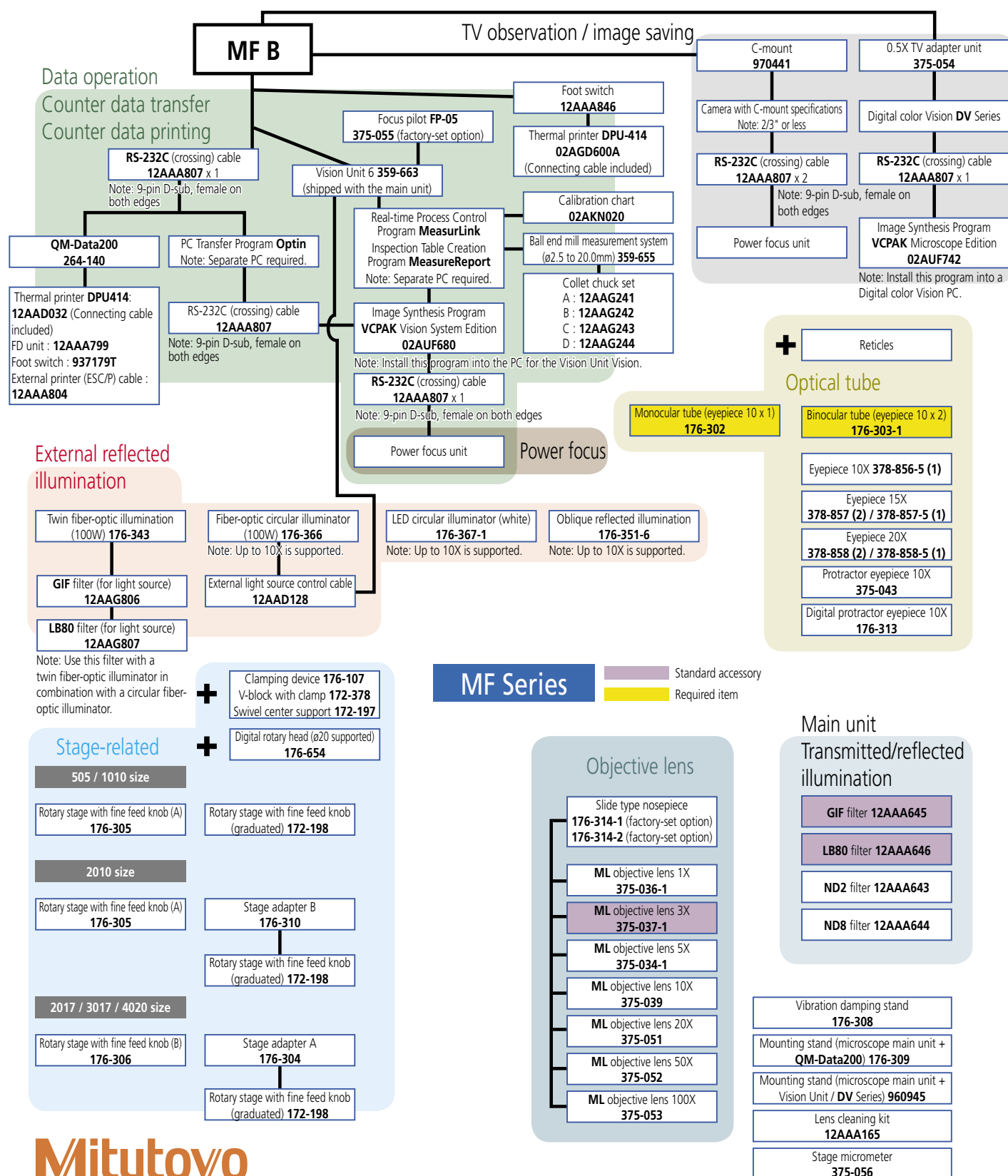
(For reflected illuminator): 100 W light source: 12 V 100 W long-life type No. **517181**, 12 V, 100 W high luminance type No. **12BAD602**

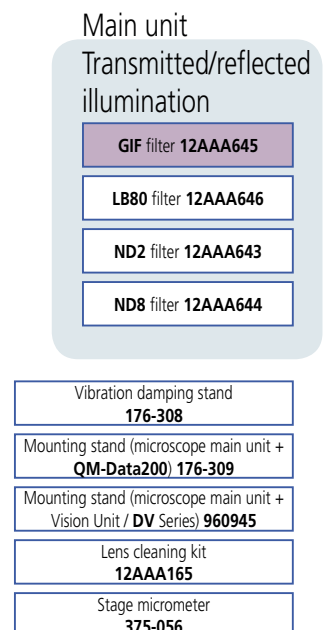
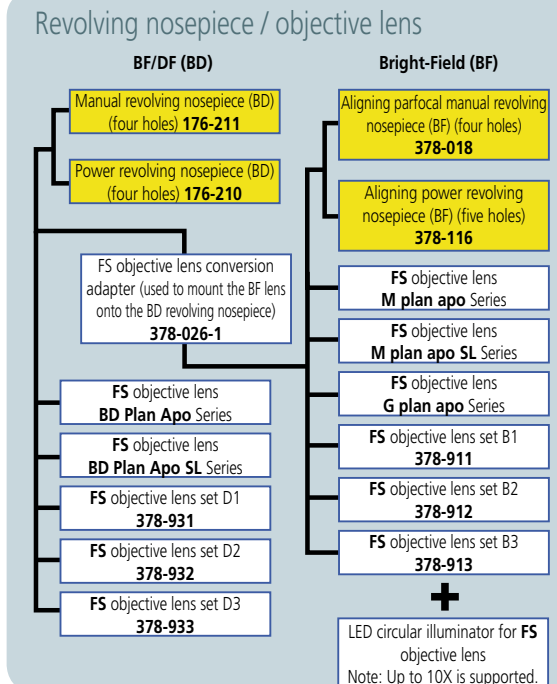
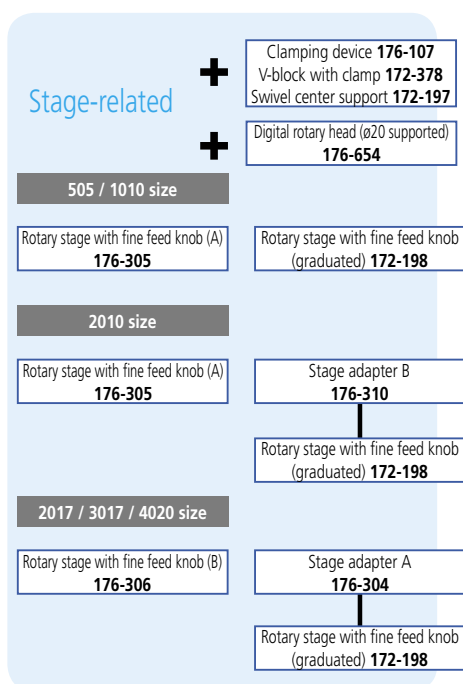
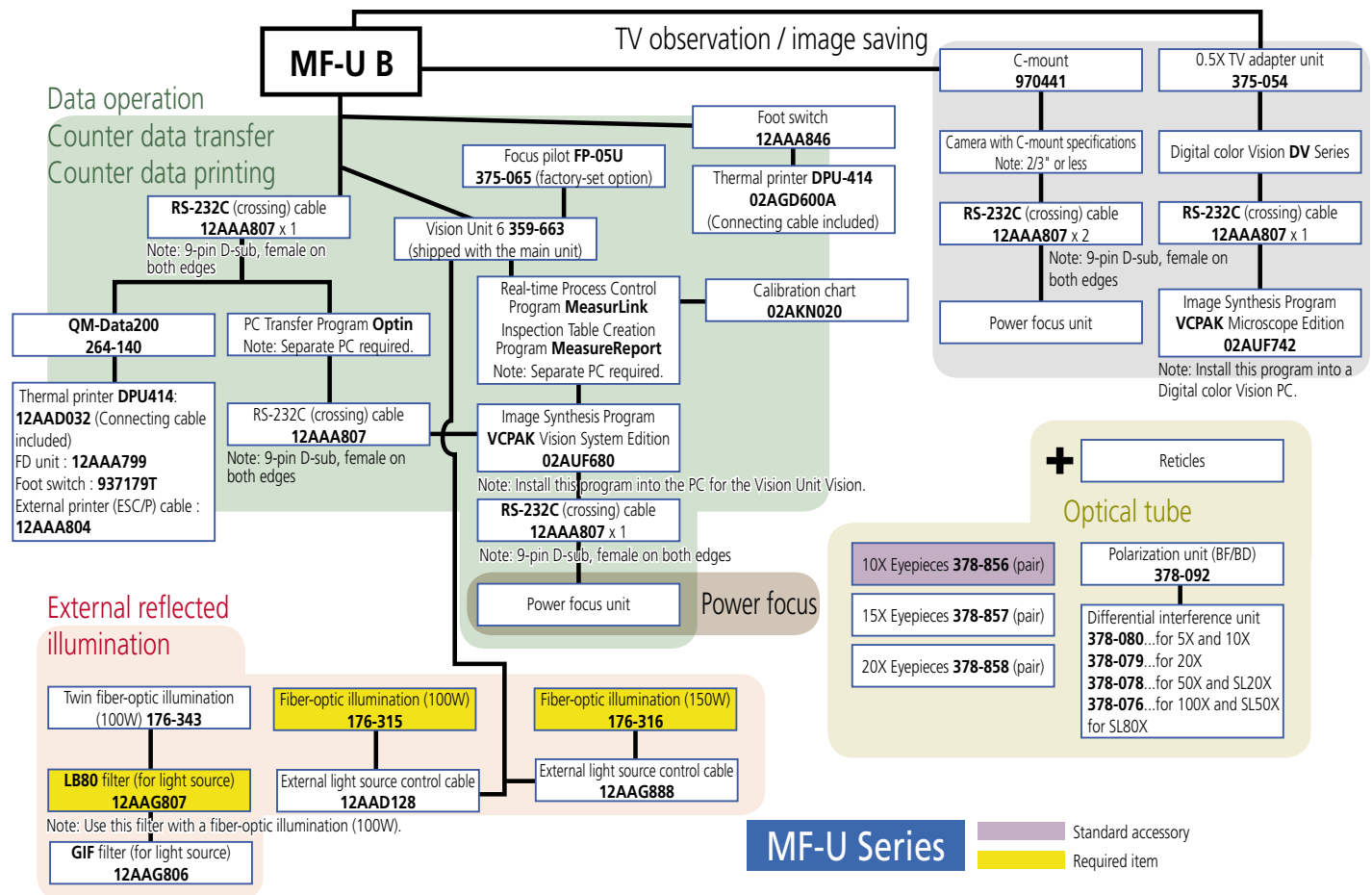
150 W light source: 12 V 150 W long life type No. **12BAJ076**, 12 V 100 W high luminance type No. **12BAJ075**

External Dimensions Chart (unit: mm)



Option Diagrams





Lens Options

Naturally it is important that a user does not tire easily, even during lengthy periods of observation or measurement. Therefore these microscopes incorporate ergonomic design features such as widefield eyepieces (field number 24 for a 10x lens) and good eye relief to provide a relaxing view so that observation and measurement can be performed with minimal strain. Also, the standard objective lens series is a low-flare design with a long working distance. The FS objective lens for both BF and BF/DF are plan apochromat.

Eyepieces

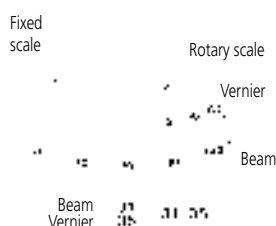
MF / MF-U



Eyepiece	WF10X / 24	WF15X / 16	WF20X / 1
Order No. (1)	378-856-5	378-857-5	378-858-5
Order No. (pair)	378-856	378-857	378-858
Magnification	10X	15X	20X
Field number	24	16	12
Applicable model	MF B / MF-U B		

*Eye shade comes with 10X models.

MF



Protractor Eyepiece	
Order No.	375-043
Magnification	10X
Field number	21
Graduations	360° 5'
Applicable model	MF B

MF



Digital Protractor Eyepiece	
Order No.	176-313
Magnification	10X
Field number	18
Reticle	90° solid line, 45° broken line (line width: 5µm for both)
Measuring range	Decimal degrees : 0.00° to ±369.99° Degrees-minutes : 0°00' to ±369°59'
Detection method	Electrostatic capacitance linear scale
External dimensions (mm)	ø120 (OD) x 140 (D)
Minimum reading	0.01° (degree) or 1' (arc-minute)
Functions	Zeroret, ABS/INC switching, decimal degree / degree-minute switching, direction switching data output (The foot switch No. 937179T is to be used at the same time)
External output	RS-232C
External dimensions (mm)	143 (W) x 112 (D) x 57 (H)
Power supply	100 to 120VAC
Applicable model	MF (can be fixed on the top of the counter.)

Optical Tubes



Monocular Tube	
Order No.	176-302
Magnification	10X
Field number	24
Applicable model	MF B



Binocular Tube	
Order No.	176-303-1
Magnification	10X
Field number	24
Applicable model	MF B



Tilting Binocular Tubes	
Magnification	10X
Field number	24
Angle of column (tilted angle)	0 to 30°
Applicable model	Standard accessory for MF-U B

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High resolution and long working distance of the objective lens are important factors promoting ease of operation when a microscope is used for inspection, observation or measurement. To obtain a clear image across the view field, apochromat specifications where chromatic aberration is compensated (compensation of red, blue, and yellow wavelengths) over a wide range of visible light are important, as are plan specifications where image surface warp, point aberration and other elements are compensated. FS objective lenses are high performance objective lenses combining these factors. This series has expanded the application range of microscopes and significantly improved ease of operation. M Plan Apo Series are lenses for BF observation using visible light. BD Plan Apo Series can be used for BF and DF observation. SL (Super Long) specifications are useful when a longer working distance is required. G Plan Apo Series are lenses that enable observation through glass. Glass thickness is compensated for 3.5mm (2 to 5mm custom designs are available).

ML Objective Lenses Limited correction optical system...for MF B



Model No.	Order No.	Magnification	N.A.	Working Distance (mm)	Depth of Focus $\pm$ (μ m)
ML 1X	375-036-1	1X	0.03	61	306
ML 3X	375-037-1	3X	0.09	77	34
ML 5X	375-034-1	5X	0.13	61	23
ML 10X	375-039	10X	0.21	51	6.2
ML 20X	375-051	20X	0.42	20	1.6
ML 50X	375-052	50X	0.55	13	0.9
ML 100X	375-053	100X	0.70	6	0.6

FS Objective Lenses

Unlimited correction optical system...for MF-U B

For Bright-Field (BF) observation and measurement



Model No.	Order No.	Magnification	N.A.	Working Distance (mm)	Depth of Focus $\pm$ (μ m)
M Plan Apo 1X	378-800-3	1X	0.025	11.0	440
M Plan Apo 2X	378-801-3	2X	0.055	34.0	91
M Plan Apo 5X	378-802-3	5X	0.140	34.0	14
M Plan Apo 10X	378-803-3	10X	0.280	33.5	3.5
M Plan Apo 20X	378-804-2	20X	0.420	20.0	1.6
M Plan Apo 50X	378-805-3	50X	0.550	136.0	0.9
M Plan Apo 100X	378-806-3	100X	0.700	6.0	0.6
M Plan Apo SL 20X	378-810-3	20X	0.280	30.5	3.5
M Plan Apo SL 50X	378-811-3	50X	0.420	20.5	1.6
M Plan Apo SL 80X	378-812-3	80X	0.550	15.0	1.1
M Plan Apo SL 100X	378-813-3	100X	0.700	13.0	0.9
M Plan Apo SL 200X	378-816-3	200X	0.620	13.0	0.7
M Plan Apo HR 50X	378-814-4	50X	0.750	5.2	0.48
M Plan Apo HR 100X	378-815-4	100X	0.900	1.3	0.34
G Plan Apo 20X (t3.5)	378-847	20X	0.280	Air conversion 29.42	3.5
G Plan Apo 50X (t3.5)	378-848-3	50X	0.500	Air conversion 13.89	1.1
Lens set B1	378-911	Set of M Plan Apo 10X, 20X, 50X, and 100X			
Lens set B2	378-912	Set of M Plan Apo 2X, 5X, 10X, and SL20X			
Lens set B3	378-913	Set of M Plan Apo 5X, 10X, 20X, and 50X			
FS objective lens conversion adapter	378-026-1	Used when setting the Bright-Field BF lens onto the BF/DF BD revolving nosepiece.			

For BF/DF (BD) observation and measurement



Model No.	Order No.	Magnification	N.A.	Working Distance (mm)	Depth of Focus $\pm$ (μ m)
BD Plan Apo 2X	378-831-5	2X	0.055	34.0	91
BD Plan Apo 5X	378-832-5	5X	0.140	34.0	14
BD Plan Apo 10X	378-833-5	10X	0.280	34.0	3.5
BD Plan Apo 20X	378-834-4	20X	0.420	20.0	1.6
BD Plan Apo 50X	378-835-5	50X	0.550	13.0	0.9
BD Plan Apo 100X	378-836-5	100X	0.700	6.0	0.6
BD Plan Apo SL 20X	378-840-5	20X	0.280	30.5	3.5
BD Plan Apo SL 50X	378-841-5	50X	0.420	20.0	1.6
BD Plan Apo SL 80X	378-842-5	80X	0.500	13.0	1.1
BD Plan Apo SL 100X	378-843-5	100X	0.550	13.0	0.9
BD Plan Apo HR 50X	378-845	50X	0.750	5.2	0.48
BD Plan Apo HR 100X	378-846	100X	0.900	1.3	0.34
Lens set D1	378-931	Set of BD Plan Apo 10X, 20X, 50X, and 100X			
Lens set D2	378-932	Set of BD Plan Apo 2X, 5X, 10X, and SL20X			
Lens set D3	378-933	Set of BD Plan Apo 5X, 10X, 20X, and 50X			

Illumination Options

Using illumination effectively is key to clearly observing and measuring a variety of targets such as semiconductors, electrical and electric parts, automobile precision parts, plastic molding, tools, medical products, and documents with a high image contrast. Choose the illumination best suited to the form, surface status, color, material of the target.



Printed wiring



HDD suspension



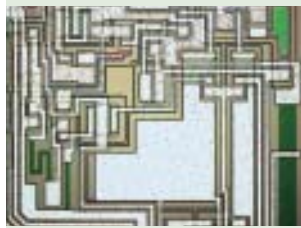
HDD suspension



Printed wiring

A : Vertical Illumination

This vertically illuminates the target surface through the objective lens.
MF: standard halogen illumination, MF-U: fiber halogen illumination



IC circuit

C : LED Circular Illuminator

This illuminator circularly emits LED light from the periphery of the objective lens and features a high luminance, long lifetime*, and low power consumption. As high image contrast is achieved, especially when a dark colored plastic, PCBs, and small cylinders are observed, this is also suitable for image measurement.

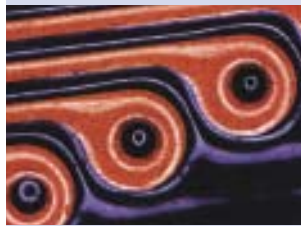
*Note that lifetime will be shortened if the maximum illumination intensity is always set.



Black plastic molded product

B : Fiber-Optic Circular Illuminator

This illuminator circularly emits halogen light from the periphery of the objective lens, enabling observation with minimal shading. With a high color reproducibility, this type of illumination is suitable for image measurement as well.



Flexible substrate



Printed wiring



Electronic parts

D : Twin Fiber-Optic illuminator

This illuminator, which obliquely emits halogen light from two directions, is best suited to three-dimensional observation. A condenser lens, which enables a high luminance spot illumination, is standard equipment with this illuminator.



IC package



Garnet



Printed wiring

> The images in the four corners of the overall figure are of the same section of printed wiring.

Images on this page are digital images, so they differ somewhat from the actual images.



150 W fiber-optic illumination

100 W/150 W Fiber Illuminator (external light source specifications)

Order No.	176-315 (100W)	176-316 (150W)
100W	12 V 100 W tungsten-halogen lamp (No. 517181), rated life: 1000hrs.	
	12 V 100 W high luminance tungsten-halogen lamp (No. 12BAD602), rated life: 50hrs.	
	Non-stepped brightness control	
External dimensions (mm)	76 (W) x 235 (D) x 120 (H), glass fiber cable length: 1500	
150W	12 V 150 W tungsten-halogen lamp (No. 12BAJ076), rated life: 500hrs.	
	12 V 150 W high luminance tungsten-halogen lamp (No. 12BAJ075), rated life: 50hrs.	
	Non-stepped brightness control	
External dimensions (mm)	120 (W) x 273 (D) x 119 (H), glass fiber cable length: 1500	
Applicable model	Option required by MF-U B (for vertical reflected illumination)	

Mitutoyo



Fiber-Optic Circular Illuminator (external light source specifications)

Order No.	176-366
	Non-stepped brightness control Auto-brightness control when the Vision Unit system is used (a separate No. 12AAD128 cable is required.) 12 V 100 W tungsten-halogen lamp (No. 517181), rated life: 1000hrs. 12 V 100 W high luminance tungsten-halogen lamp (No. 12BAD602), rated life: 50hrs. LB80 filter (No. 12AAG807)
External dimensions (W x D x H)mm	76 x 235 x 120 (light source section only) OD : ø60, ID : ø35 (circular illuminator section) Fiber length: 1000
Applicable model	MF B (ML objective lens 10X or less)

LED Circular Illuminator

Order No.	176-367-1
	Non-stepped brightness control
External dimensions (W x D x H)mm	75 x 150 x 90 (control section only) OD: ø70, Overall length: 68 to 93 (circular LED section) LED cable length: 1500
Applicable model	MF B (ML objective lens 10X or less)



MF-B3017B + Circular LED Illumination



Oblique Reflected Illuminator

Order No.	176-351-6
	Oblique illumination using the reflected illumination light source in the microscope main unit Equipped with non-stepped brightness control and condenser lens. 12V50W (No. 513667)
Applicable model	MF B (ML objective lens 10X or less)

Twin Fiber-Optic Illuminator (external light source specifications)

Order No.	176-343
	Fixed to the back of microscope column. Equipped with a non-stepped brightness control and condenser lens. 12 V 100 W tungsten-halogen lamp (No. 517181), rated life: 1000hrs. 12 V 100 W high luminance tungsten-halogen lamp (No. 12BAD602), rated life: 50hrs. LB80 filter (No. 12AAG807)
External dimensions (W x D x H)mm	76 x 235 x 120 (light source section only) Fiber length: 700 (from the back fixture to the tip) Maximum fiber bend R: R60
Applicable model	MF B / MF-U B

LED Circular Illuminator (for FS objective lens)

Order No.	Contact us.
	Fixed to the objective lens. Circularly emits white LED light.
	Non-stepped brightness control
External dimensions (W x D x H)mm	75 x 150 x 90 (control section only) OD: ø70, Overall length: 65 to 80 (circular LED section) LED cable length: 1000
Applicable model	MF-U B (FS objective lens M Plan Apo 10X or less)

Image Measurement Option Vision Unit

Measurement results can be instantly displayed by specifying the desired command from various options based on the digital counter output on the microscope main unit. Highly versatile electronic and image measurement functions, where image processing is used to align edges, are available. The measurement results can be printed and output to a spreadsheet application or inspection table.

Vision Unit



MF-B1010B + Vision Unit

Features

- › Automatic edge detection tool that enables instant measurement and a variety of macro types
- › Graphics and measurement navigation function that supports easy operation
- › Measurement results can be output to MS-Excel*, and an inspection table can be created using the same personal computer.
- › Tolerance zone measurement and per-item statistical processing
- › Auto-brightness control function that exactly reproduces illumination settings (when the MF B and MF-U B measuring microscopes are used at the same time)
- › High accuracy height measurement is possible with the aid of the focus pilot
- › Measurement within a single screen image
- › Functions to input and save images

* MS-Excel is a registered trademark of Microsoft Corporation.

Instant Manual Measurement

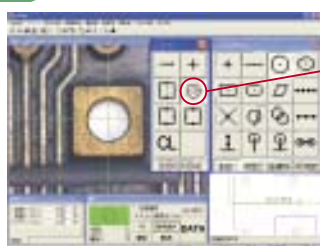
The CCD camera integrated into the microscope automatically detects the edge of the target and instantly displays operation results if the edge is within the video screen.

In addition to fewer edge alignment errors, higher repeatability and reduction of measurement time, simultaneous monitoring of measured points is also possible.

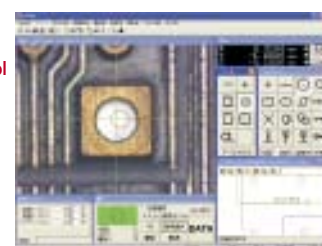
Example of internal diameter measurement



(1) Display the target to be measured in the video window and adjust illumination and focus on the main unit of the measuring microscope.



(2) Select the measurement function "Circle Measurement" from the function window and the edge detection tool "One-Click Circle Tool" from the tool window.



(3) Click on the edge of the target hole once: the edge is automatically detected and the measurement process started.



(4) Measurement results are displayed.

Specifications

Vision Unit	
Order No.	359-698/359-699
Optical magnification	0.5X when installed into the microscope (with the 0.5X TV adapter)
Image detection	High-sensitivity 1 / 3" CCD color camera
Monitor display magnification	About 21X (About 63X with the objective lens 3X, Image range: 3.1 x 2.3mm)
Maximum resolution	0.1μm
Measuring accuracy at each axis*1 (measurement temperature: 20°C)	Depends on the accuracy of measuring microscope.
Repeatability*2 (measurement temperature: 20°C)	Depends on the accuracy of measuring microscope. Reference: Repeatability on a single screen (Mitutoyo reference samples were used.) With 3X objective lens: $3\sigma = \pm 2.5\mu\text{m}$ or less With 10X objective lens: $3\sigma = \pm 1.0\mu\text{m}$ or less
PC system	Pentium4, WindowsXP
Software	QS PAK Visionunit Edition V1.0
Maximum power consumption	460 W
Applicable model	MF B/MF-U B

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Data Processing Option QM-Data200

QM-Data200



MF-UB1010B + QM-Data200

Features

- › Supports two-dimensional measurement work with a variety of graphic display functions that take advantage of a large LCD screen.
- › Frequently used combined measurement (such as center-to-center measurement between two circles) can be performed with a single key operation from the key panel.
- › AI measurement function (to automatically identify measured elements)
- › Measurement procedure teaching function and measuring point navigation function in the repeat mode
- › User menu function by which measurement commands specific to users and part programs can be stored and saved.
- › Measurement procedures and results can be stored on floppy disks using an optional FDD unit.
- › Tolerance zone measurement of measurement operation results and per-item statistical processing
- › Measurement results can be output to MS-Excel* in CSV format.
- › Stand with tilt mechanism
- › Measurement is possible while printing data.

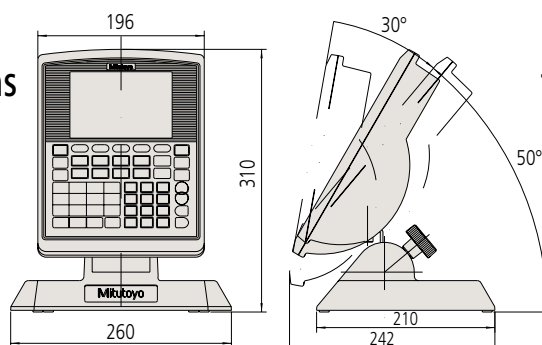
* MS-Excel is a registered trademark of Microsoft Corporation.

Specifications

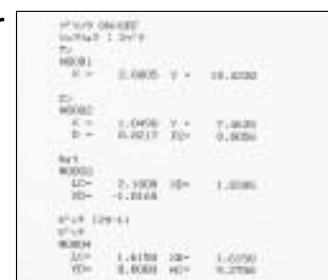
QM-Data200 (stand type)	
Order No.	264-140
Display language	Seven languages supported (Japanese, English, German, French, Italian, Spanish, and Portuguese) *Chinese and Korean models are also available.
Measurement units	Length: mm, angle: degrees or degree/arc-minute/arc-second (switchable)
Maximum resolution	0.1μm
Program function	Creation, execution, and editing of measurement procedures
Statistical processing	Measurement item, number of data, maximum value, minimum value, average, standard deviation, range, histogram
Element memory capacity	Up to 1000 elements
Element recall	Point, line, circle, distance, ellipse, rectangular hole, slotted hole, intersection and intersecting angle
Element key entry	Point element, line element, circle element
Display unit	Monochrome graphic LCD (320 x 240 dots, backlight)
ABS	Not supported
LAF (laser AF)	Not supported
Input connector	(1) RS-232C2: to connect the counter of the microscope main unit (2) X, Y, Z: linear scale input (for counter-less type) (3) OPTOEYE: optoeye edge signal (for optoeye M2 connection) Note: Usable only when linear scale input is used. (4) FS: to connect the foot switch
Output connector	(1) RS-232C1: to connect a personal computer (measurement result) (2) PRINTER: to connect the receipt/external printer (measurement result) (3) FD: to connect the FDD unit (measurement result file and measurement procedure file)
Measurement result file output	RS-232C output (CSV format, MUX-10 format)
Power supply	100 VAC 50/60 Hz (using AC adapter)
Maximum power consumption	24 W (not including options)
External dimensions (mm)	About 260 (W) x 242 (D) x 310 (H) (including the stand section)
Weight	About 2.2 kg
Applicable model	MF B/MF-U B
Standard accessory	AC adapter and power cable

External Dimensions

(unit: mm)



Print example of DPU-414 thermal printer



Print example of receipt printer

Image and Vision Analysis Options

The Digital color Vision DV Series digital color image system can meet the needs of customers who want to easily take and save microscope images. High-definition images can be saved in a file and a quick measurement function that can be used within a single screen image is also available. We also offer VCPAK with which an omnifocal image focusing on the whole view field can be generated, even with a lens having a shallow depth of focus, and transferred to a 3D display.

DV Series Digital color Vision



MF-UB1010B + DV520L

Features

- › 50-, 210-, and 520-megapixel digital cameras are available.
- › High-speed image filing and manual quick measurement function
- › High image quality and almost real-time follow-up
- › Direct C-mount non-vignetting design

DV Series Digital color Vision			
Model No.	DV-520	DV-210	DV-50
Order No.	176-382	176-384	176-380
Type and size	Color CCD	Color CCD	Color CMOS
	2 / 3"	1 / 2"	1 / 3"*1
Diagonal length (mm)	11	8	6
Monitor display magnification*2	About 30X	About 33X	About 40X
Total pixel count	About 524 megapixels	About 210 megapixels	About 50 megapixels
Lens mount	C-mount		
Major functions	Image filing	Supported	
	Ultra-fine electric cross line	Supported	
	Manual quick measurement	Supported	
	Scale and comment display	Supported	
PC system	OS	Windows XP®	
	Optical drive	CD-RW (writing software included)	
	Monitor*Note	17" high-definition LCD	

*1: The DV-50 employs the CMOS image sensor, so the image might jiggle during shooting.

*2: Display magnification for 17" CRT. A margin is displayed at the lower right on the screen in the case of the DV-50 (standard screen display setting of 800 x 600).

Note: Digital color Vision DV Series is confirmed and guaranteed with the DELL PC system (Windows XP). Note that image capturing is not guaranteed in other PC systems. The configuration of the PC system is subject to change. Please check in advance.

› Windows is a registered trademark of Microsoft Corporation.

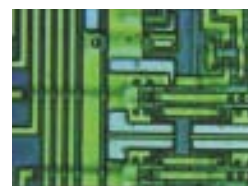
VCPAK Image Synthesis Program



Images on this page are digital images, so they differ somewhat from the actual images.



LCD color filter

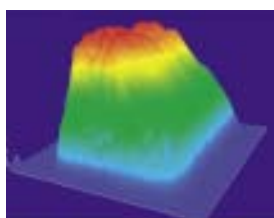


LSI circuit

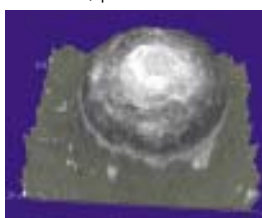
Features

- › Image generation program focusing on the whole microscope view field (omnifocal)
- › Images can be captured by only pressing the capture button on the monitor (The motor-driven automatic input function can be integrated into the system.)
- › Zooming in/out and rotating 3D* images is possible with the mouse and the images can be saved in BMP format.
- *Supported by 3-axis MF B or MF-U B.
- › Analysis of bumps, solder balls, IC pattern circuits, LCD electrodes, steps on painted film, powders and other targets

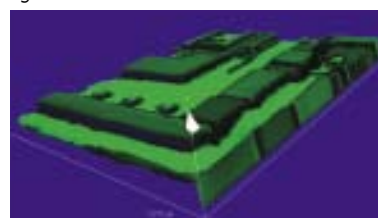
Mitutoyo



Tip of connector pin



LSI



BGA

Optional Accessories

We offer options that support the ease of operation of measuring microscopes. A focus pilot that reduces the dispersion of the focusing point, power revolving nosepiece and power focus unit that enable changing magnification and focusing by hand, a digital rotary head which digitally measures angles, a rotary table with a fine feed wheel enabling smooth rotational movement of the target, and other options are highly developed. Choose options such as polarization and differential interference contrast units which support metallographic microscope observation, TV port adapter for setting the camera required for multiple users to simultaneously perform analysis and evaluation according to the application.



Mounted onto the TV port of the microscope main unit as an add-on function, the focus pilot can detect the focus point with high accuracy and reproducibility. Adjustment of the brightness of the focus pattern is possible according to the surface condition, material, and other characteristics of the target. The internal 0.5X optical system enables a wide field of view on the TV monitor. (A separate CCD camera needs to be mounted.)
Note: Combination of MF-U B and FP-05U is a factory-fit option.

Focus Detection Unit Focus Pilot		
Model No.	FP-05	FP-05U
Order No.	375-055	375-065 (factory-set option)
	Mounted onto the TV camera port of the microscope main unit, the focus pilot can detect the focus point with high accuracy and reproducibility. An internal 0.5X optical system enables a wide field of view on the TV monitor. (A separate CCD camera needs to be used.) ➤ Concentric circle pattern ➤ Slit pattern   • The point where either of the above patterns matches between the upper and lower parts is the focus point. • A pattern can be selected and the brightness can be adjusted according to the surface characteristics of the target.	
Focus reproducibility	About 1.5μm (with 20X lens); reference value measured by Mitutoyo using samples	
Optical magnification	0.5X	
Magnification accuracy	±0.1% (within 2/3 from the center of the view field)	
Camera	Up to 2/3" are supported	
TV adapter	C-mount and centering/parfocal adjustment mechanism	
Power supply	100 V to 240 VAC, maximum power consumption about: 20 W	
External dimensions (mm)	Main unit section: 131 (H) Console box: 90 (W) x 78 (H) x 178 (D)	
Applicable model	MF B	MF-U B



This is an electrically driven revolving nosepiece to be mounted onto the MF-U Series. The objective lens can be specified using the remote console box. The centering mechanism is standard equipment for the Bright-Field BF model only.

Power Revolving Nosepiece		
Order No.	378-116 (Bright-Field BF model)	176-210 (BF/DF BD model)
	Electric drive revolving nosepiece mounted onto MF-U B The objective lens can be switched by hand.	
Objective lens mounting	5 (with the centering mechanism)	4
View field adjustment range	±0.5mm	None
Driving means	DC motor	
Power supply	100 V to 240 VAC, maximum power consumption about 20 W	
External dimensions (mm)	Main unit section: 164 (W) x 65 (H) x 137 (D) Console box: 108 (W) x 72 (H) x 193 (D)	
Applicable model	MF-U B	



This is mounted onto the left Z axis handle of the main unit. Fine feed focusing using the remote power jog dial and seven-speed coarse feed focusing using the jog shuttle are available.

Power Focus Unit



Digital Rotary Head	
Order No.	176-654
	A unit that digitally displays the rotation angle. Angle indexing supported.
Digital angle display	0.1° (switched); Accuracy is not guaranteed.
Rotation drive	Manual (amount of head rotation: 0.5 rotation per one handle rotation)
Collet capacity (mm)	ø2.5 to ø20.0 Note: The collet chuck is optional.
Power supply	100 to 120, 220 to 240 VAC 50/60Hz
External dimensions (mm)	160 (W) x 220 (D) x 88 (H)
Applicable model	MF B



Collet Chuck Set	
Set A (No. 12AAG241)	Collet capacity: 2.5 to 5.0mm
Set B (No. 12AAG242)	Collet capacity: 5.5 to 10.0mm
Set C (No. 12AAG243)	Collet capacity: 10.5 to 15.0mm
Set D (No. 12AAG244)	Collet capacity: 15.5 to 20.0mm
Applicable model	MF B



Note: External lighting cannot be used with this product.

Slide Type Nosepiece	
Order No.	176-314-1 (factory-set option)
	The lens of centering mechanism (reference) hole and that of focus adjusting mechanism hole are parfocal. Note: The magnification of focus adjusting function hole is not guaranteed.
Order No.	176-314-2 (factory-set option)
	The magnification of the lens of the centering mechanism (reference) hole and that of the focus adjusting mechanism hole are guaranteed. Note: The two lenses are not parfocal.
Applicable model	MF B

Optional Accessories

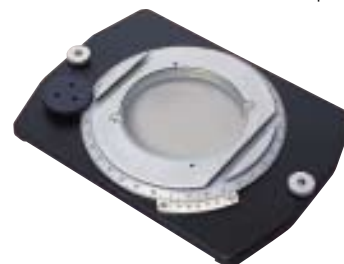
We offer a variety of options for more efficient observation and measurement. We support ease of operation of measuring microscopes with a rotary table which has a fine feed wheel that enables smooth rotational movement of the target, a vibration damping stage which is essential for high magnification observation and measurement, polarization and differential interference contrast units to broaden the choice of surface observation, TV port adapters which are or CCD camera observation as well as view field observations and measurements, and other options.



Rotary table with fine feed wheel (A)	
Order No.	176-305
External dimensions (mm)	280 (W) x 280 (D) x 24 (H) mm
Table top	ø240mm, 360° rotation, no angle reading
Weight	5.5kg
Effective glass size (mm)	ø183
Applicable model	505 / 1010 / 2010 size (MF B/MF-U B)
Note: The V-block with clamp, swivel center, and adjustable clamp can be fixed onto the table.	



Rotary table with fine feed wheel (B)	
Order No.	176-306
External dimensions (mm)	342 (W) x 342 (D) x 23 (H) mm
Table top	ø410mm, 360° rotation, no angle reading
Weight	6.5kg
Effective glass size (mm)	ø240
Applicable model	2017 / 3017 / 4020 size (MF B / MF-U B)
Note: The V-block with clamp, swivel center, and adjustable clamp cannot be fixed onto the table.	



Rotary table with fine feed wheel (graduated)	
Order No.	172-198
External dimensions (mm)	240 (W) x 172 (D) x 19.7 (H) mm, table top T-slot pitch: 120 Table top: ø146mm, 360° rotation, minimum angle reading vernier: 2'
Weight	2.5kg
Effective glass size (mm)	ø94
Applicable model	MF B / MF-U B
Note: Use stage adapter B in for the 2010 size model. Use stage adapter A for the 2017, 3017, and 4020 size models.	

Note: The V-block with clamp, swivel center, and adjustable clamp can be fixed onto the table.



V-Block with Clamp	
Order No.	172-378
Maximum supportable diameter	ø25mm
High from the mounted surface to the center	38 to 48mm
External dimensions (mm)	117 (H) x 90 (W) x 45 (D) mm
Weight	0.8kg
Applicable model	MF B / MF-U B
Note: Use stage adapter B for the 2010 size model. Use stage adapter A for the 2017, 3017 and 4020 size models.	



Swivel Center	
Order No.	172-197
Can be tilted within ±10°, minimum angle reading: 1°	Most appropriate for measurement screws and other items
Maximum supportable size	80 x 140mm when horizontal
Maximum supportable size	65 x 140mm when tilted by 10°
Weight	2.5kg
Applicable model	MF B / MF-U B
Note: Use stage adapter B for the 2010 size model. Use stage adapter A for the 2017, 3017, and 4020 size.	



Adjustable Clamp	
Order No.	176-107
Maximum clamp length (mm)	35
External dimensions (mm)	62 (H) x 152 (W) x 38 (D) mm
Weight	0.4kg
Applicable model	MF B / MF-U B
Note: Use stage adapter B for the 2010 size model. Use stage adapter A for the 2017, 3017, and 4020 size.	



Vibration damping stand	
Order No.	176-308
Supporting	Spring pad
Maximum loading	200kg
External dimensions (mm)	750 (W) x 550 (D) x 36 (H) mm
Weight	36kg
Applicable model	MF B / MF-U B



Mounting Stand (for microscope main unit)	
Order No.	176-309
Maximum loading	300kg
External dimensions (mm)	1200 (W) x 900 (D) x 650 (H) mm
Weight	About 50 kg
Applicable model	MF B / MF-U B

Note: We recommend the large-sized mounting stand (960945) having external dimensions of 1800 (W) x 900 (D) x 740 (H) when integrating the Vision Unit and digital color vision into the microscope main unit.



Stage Adapter A/B	
Order No.	A : 176-304 / B : 176-310
External dimensions, one piece (mm)	50 (W) x 340 (D) x 15 (H)
Weight	A : 1.5kg / B : 1.2kg
Applicable model	MF B / MF-U B

Note: One pair in a set



Polarization Unit	
Order No.	378-092 (common to BF and BF/DF) Polarizer and analyzer one each per set.
Applicable model	MF-U B

Differential Interference Units	
Order No.	378-080 (for 5X and 10X) 378-079 (for 20X) 378-078 (for 50X and SL20X) 378-076 (for 100X, SL80X, and SL50X)
Applicable model	MF-U B

Note: Use the polarization unit at the same time.



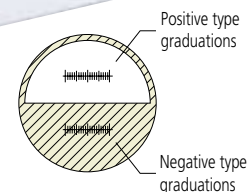
C-Mount	
Order No.	970441
	Standard adapter used to mount a digital camera or other device onto the TV camera port of the microscope main unit. Note: Not used when an Vision Unit is mounted.
External dimensions (mm)	ø45x22.5 (H)
Applicable model	MF B / MF-U B



0.5X TV Adapter (with C-Mount)	
Order No.	375-054
	Standard adapter used to mount a digital camera or other device onto the TV camera port of the microscope main unit. 0.5X reduction relay image enables wide field observation. Magnification accuracy: $\pm 0.1\%$, image view field: ø11mm Note: Supplied as standard with the Vision Unit.
External dimensions (mm)	ø45x123 (H)
Applicable model	MF B / MF-U B

Illumination Filters		
For the light source in the microscope main unit*	GIF filter	12AA645
	LB80 filter	12AA646
	ND2 filter	12AA643
	ND8 filter	12AA644
For the light source of reflected illumination (for 100 W fiber-optic illumination)	GIF filter	12AAG806
	LB80 filter	12AAG807

*MF B (common to transmitted and reflected illumination) / MF-U B (transmitted illumination only)



Stage micrometer	
Order No.	375-056
Scale graduation	1mm
Minimum graduation	0.01mm
Scale accuracy (20°C)	1 + L (μm), L: length between any two lines (mm)
Graduations	Negative/positive type
External dimensions (mm)	76 (W) x 26 (D) mm
Weight	16g
Applicable model	MF B / MF-U B

Note: Mitutoyo supports calibration after purchase. For details, contact your nearest sales office.

DPU-414 Thermal Printer		Manufactured by SII
Order No.	QM-Data200 connected	12AAD032
	Counter display printing	02AGD600A Note: Use foot switch No. 12AAA846 at the same time.
Printing method	Dot-matrix thermosensitive paper	
Characters per line	40 (normal characters 9 x 7 dot matrix)	
Printing speed	52.5 characters / s max. (normal character)	
External dimensions	160mm (W) x 170mm (D) x 65.5mm (H), (printer main unit)	
Standard accessories	Printer cable, one paper roll, AC adapter (for 100 V)	
Optional	Paper for printer	No. 908353 (5 rolls)
	ESC / P printer cable	No. 12AAA804 (2 m), 24-pin, color / monochrome support



Lens Cleaning Kit	
Order No.	12AAA165
	Dedicated to eyepiece and objective lens maintenance Set of cleaner, cloth, blower, cotton wads, and other items
Applicable model	MF B (common to transmitted and reflected illumination)/MF-U B (transmitted illumination only)

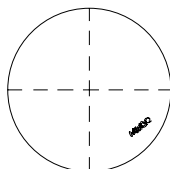
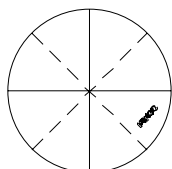
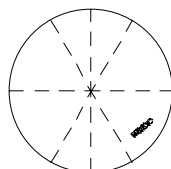
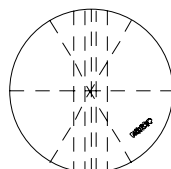
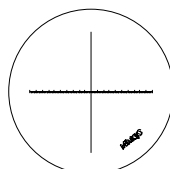
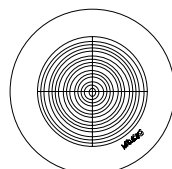
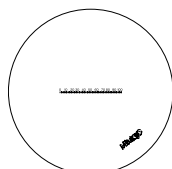
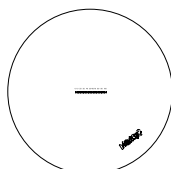
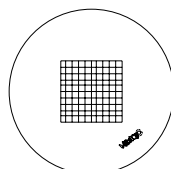
Optional Accessories

Reticles



For MF-U B

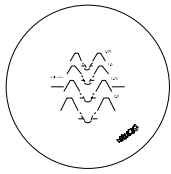
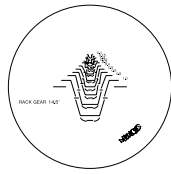
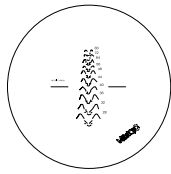
For MF B

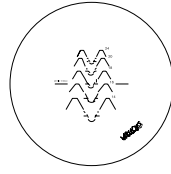
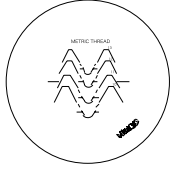
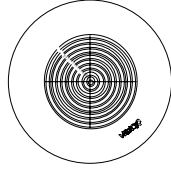
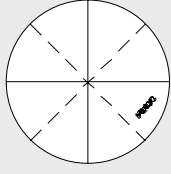
 No.12AAG838 (MF B) No.12AAG878 (MF-U B) 90° broken line Broken line pitch: 0.2 to 0.2 Line width: 7μm	No.12AAG836 (MF B) No.12AAG877 (MF-U B) 90° broken line Broken line pitch: 0.2 to 0.2 Line width: 5μm No.12AAG873 (MF B) No.12AAG876 (MF-U B) 90° broken line Broken line pitch: 0.2 to 0.2 Line width: 3μm	 No.12AAG839 (MF B) No.12AAG879 (MF-U B) 90° solid line, 45° broken line Broken line pitch: 0.2 to 0.2 Line width: 5μm	 No.12AAG840 (MF B) No.12AAG880 (MF-U B) 90° solid line, 60° broken line Broken line pitch: 0.2 to 0.2 Line width: 5μm	 No.12AAG841 (MF B) No.12AAG881 (MF-U B) Zeiss pattern Broken line pitch: 0.2 to 0.2 Line width: 5μm
 No.12AAG842 (MF B)*¹ Cross hairs graduated line 0.1 / 20mm Line width: 7μm	 No.12AAG843 (MF B)*¹ Concentric circles with cross hairs ø1.2 to ø18 Line width: 7μm	 No.12AAG844 (MF B)*¹ Graduated line 0.1/10mm Line width: 10μm	 No.12AAG845 (MF B)*¹ Graduated line 0.05/5mm Line width: 10μm	 No.12AAG846 (MF B)*¹ Grid 1mm 1mm, 10mm 10mm Line width: 10μm

Each reticle is supplied with a mounting bracket.

*1: To be used with the eyepiece 10X.

*2: Comparison chart for ML 3X objective lens. To be used with 10X eyepiece.

				
No. 12AAG847 (MF B)*2	No. 12AAG848 (MF B)*2	No. 12AAG849 (MF B)*2	No. 12AAG850 (MF B)*2	No. 12AAG851 (MF B)*2
Metric coarse screw thread	Metric coarse screw thread	Involute gear reference rack	Involute gear reference rack	Unified coarse screw thread
P = 0.25 to 1.0	P = 1.25 to 2.0	m = 0.1 to 1.0, pressure angle: 14.5°	m = 0.1 to 1.0, pressure angle: 20°	80 to 28
Line width: 7µm	Line width: 7µm	Line width: 7µm	Line width: 7µm	Line width: 7µm

			
No. 12AAG852 (MF B)*2	No. 12AAG853 (MF B)*2	No. 12AAG854 (MF B)*2	Reticle for Digital Protractor Eyepiece (standard)
Unified coarse screw thread	Unified coarse screw thread	Concentric circles with cross hairs	90° solid line, 45° broken line
24 to 14	13 to 10	0.01" to 0.20"	Broken line pitch: 0.2 to 0.2
Line width: 7µm	Line width: 7µm	Line width: 7µm	Line width: 5µm



*For detailed information, contact your nearest Mitutoyo Sales Center.

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